International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 02 | Feb - 2026 SJIF Rating: 8.659 ISSN: 2582-3930

Border Surveillance System

Mr. Girish R. Shinde[1], Chaitanya Rajendra Dashpute[2], Siddhesh Anil Bhabad[3] Pushkar Nilesh Chaudhari[4], Chaitanya Mahendra Deshpande[5]

[1]. Lecturer, Computer Technology, K. K. Wagh Polytechnic, Nashik.
[2]. Student, Computer Technology, K. K. Wagh Polytechnic, Nashik.
[3]. Student, Computer Technology, K. K. Wagh Polytechnic, Nashik.
[4]. Student, Computer Technology, K. K. Wagh Polytechnic, Nashik.
[5]. Student, Computer Technology, K. K. Wagh Polytechnic, Nashik.

Abstract- Border security is a critical component of national defense, requiring continuous monitoring to prevent terrorist infiltration and illegal cross-border activities. Currently, surveillance is carried out manually by border security forces, demanding extensive manpower and resources due to vast terrains and harsh environmental conditions. This project proposes an automated border surveillance system designed to provide 24/7 monitoring without constant human presence. The system can detect suspicious activities, make preliminary decisions, initiate necessary actions, and send alert notifications to centralized control rooms located away from hostile areas. The proposed system utilizes advanced sensors, surveillance cameras, and intelligent processing units to accurately identify unauthorized movements in real time. By incorporating automated threat analysis and rapid alert mechanisms, it ensures faster response and improved situational awareness while minimizing human exposure to danger. Overall, the system offers a reliable, scalable, and cost-effective solution for strengthening border protection and enhancing national security.

Key words- *Intrusion Detection, Surveillance Drones, Thermal Imaging, Real-Time Monitoring, Geofencing, Automated Threat Detection.*

1. INTRODUCTION

The Border Surveillance System is a smart web-based application developed to enhance security in restricted and sensitive areas by overcoming the limitations of traditional CCTV monitoring. Unlike conventional systems that rely heavily on continuous manual observation, this solution integrates intelligent algorithms to enable automatic and real-time surveillance. A webcam is used to constantly monitor the surroundings, and FaceJs technology helps detect and identify individuals within its range. One of the main strengths of the system is its ability to clearly differentiate between known and unknown persons, which significantly improves security accuracy and reduces false alarms.

Whenever an unknown individual is detected, the system immediately generates a popup notification, allowing the operator to either grant or deny access. If access is approved, the system recalibrates and continues monitoring without interruption. However, if access is denied, it instantly activates an alarm to alert nearby personnel and simultaneously sends an email notification to the administrator along with an image of the detected intruder. This ensures that necessary action can be taken without delay.

By automating detection and alert mechanisms, the system reduces dependency on constant human supervision while maintaining round-the-clock vigilance. It minimizes human error, improves response time, and enhances overall operational efficiency. The web-based interface makes it easy to monitor and manage remotely, adding flexibility and convenience. Additionally, the system can be scaled to support multiple cameras and locations, making it suitable for various high-security environments. Overall, the proposed solution provides a reliable, efficient, and modern approach to strengthening surveillance and protecting critical zones.

2. LITERATURE SURVEY

1. Zhang Wei, Li Yong, "IoT Based Intelligent Border Surveillance System Using Wireless Sensor Networks"

Border security has become a major concern for many countries due to increasing cases of illegal infiltration, smuggling, and terrorist activities. Traditional surveillance methods that rely heavily on manual patrolling are often inefficient and prone to human error. This paper proposes Deep learning-based real-time face detection system for intelligent surveillance applications. The system utilizes convolutional neural networks (CNN) to detect and recognize human faces from live video streams. Pre-trained deep learning models are used to extract facial features and compare them with stored datasets for identification. The proposed system ensures fast detection with high accuracy under varying lighting and environmental conditions. Experimental results indicate that AI-based face detection significantly improves monitoring efficiency and reduces false alarms in high-security zones.[1]

2. Ahmed Khan, R. Prakash, "Web-Based AI Surveillance System Using Face Recognition Techniques"

The rapid growth of artificial intelligence frameworks, web-based surveillance solutions have gained importance in modern security systems. This research introduces an AI-powered surveillance model implemented using JavaScript-based deep learning libraries for face detection and recognition. The system captures video through cameras and processes frames

in real time using pre-trained models such as SSD MobileNet for face detection and Face Recognition networks for identity verification. The system is capable of detecting unknown individuals and generating alerts instantly. The proposed framework is lightweight, cost-effective, and suitable for deployment in remote border areas with limited infrastructure. The study concludes that browser-based AI models provide flexible and scalable surveillance solutions.[2]

3. S. Karthikeyan, M. Ramesh, "AI-Based Automated Intrusion Detection Using Facial Recognition Technology"

Ensuring border security requires not only detection of movement but also identification of individuals. This paper presents an AI-based intrusion detection system that integrates facial recognition algorithms to verify authorized and unauthorized persons. The system captures facial images from surveillance cameras and extracts unique facial landmarks using deep neural networks. These features are compared with a pre-defined database to determine identity. In case of mismatch, an alert is transmitted to security personnel. The model demonstrates high precision and recalls rates in identifying individuals under different poses and lighting variations. The integration of facial recognition technology enhances border monitoring by enabling intelligent decision-making and rapid threat detection.[3]

3. METHODOLOGY

The project "Border Surveillance System (BSS)" is designed to provide an automated, intelligent, and reliable solution for monitoring and protecting restricted and high-security areas. In sensitive border regions, unauthorized intrusions, illegal crossings, and security threats pose serious risks to national safety. Traditional surveillance methods largely depend on manual monitoring and basic CCTV systems, which require continuous human attention and may fail to respond instantly to suspicious activities. This project aims to overcome these limitations by implementing a smart, web-based surveillance system powered by modern detection algorithms.

The developed system uses a webcam as the primary input device, combined with FaceJs technology for real-time face detection and recognition. The system continuously monitors the area and identifies individuals within its field of view. It is capable of distinguishing between authorized and unauthorized persons. When an unknown individual is detected, the system immediately generates a notification prompting the operator to either allow or deny access. If access is denied, the system activates an alarm and automatically sends an email alert to the administrator with the captured image of the intruder.

The system is designed to reduce dependency on constant human supervision while ensuring rapid response to potential threats. By integrating automated detection, intelligent decision support, and instant alert mechanisms, the Border Surveillance System provides a secure, efficient, and scalable solution for enhancing safety in critical and restricted zones.

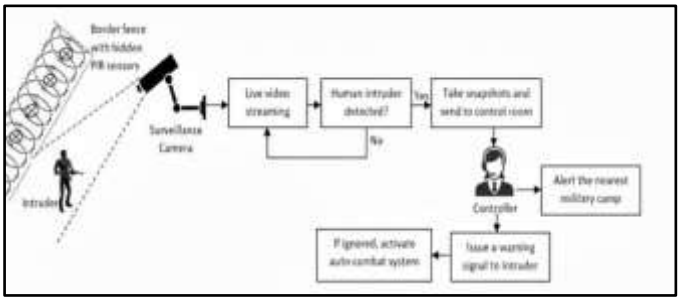

Figure 1: System Architecture

The purpose of this prototype is to provide an early visualization of the proposed web-based Border Surveillance System designed to monitor and secure restricted areas. By simulating the core functionalities—such as real-time face detection, identification of unauthorized individuals, alert generation, and automated response mechanisms—the prototype allows stakeholders to understand how the system will operate in a real-world security environment.

Additionally, the prototype serves as a platform to gather valuable feedback from potential users, security personnel, and experts before full-scale deployment. This feedback will help identify design limitations, improve system efficiency, and ensure that the final product is practical, reliable, and user-friendly.

By developing this prototype at an early stage, we aim to reduce development risks, validate design assumptions, and enhance the overall effectiveness and acceptance of the Border Surveillance System.

4. WORKING MODULE

The AI-Based Border Surveillance System using Face.js functions through video capture, face detection, identity verification, and alert management stages. A webcam continuously captures live video from the monitored area, and the frames are processed in real time using the Face.js deep learning library to detect and extract facial features.

The detected face is compared with a pre-stored database of authorized person. If a match is found, the system continues monitoring. If no match is identified, a popup alert is generated on the admin dashboard. The administrator reviews the alert and makes a decision. If approved, the details are stored in the database. If unauthorized, the system triggers an alarm and sends an email notification to authorities. The system then resumes continuous monitoring to maintain 24/7 border security.

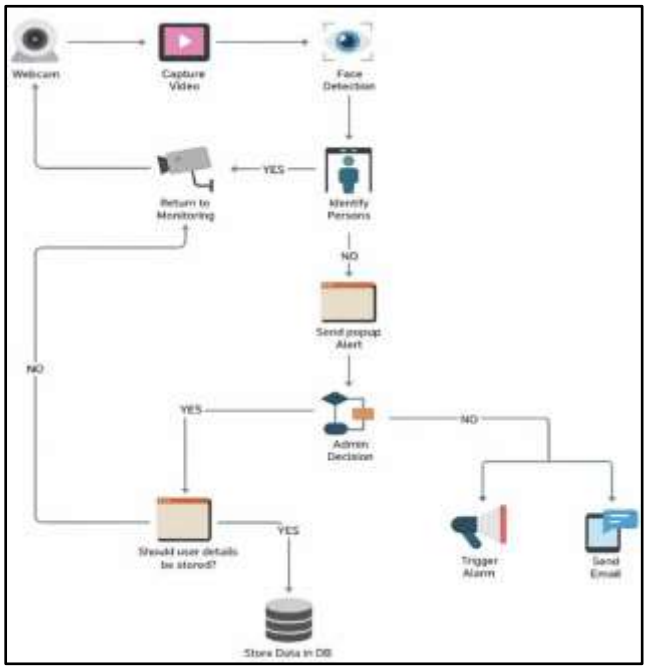

Figure 2: Working System

Used Modules and Technologies in the Implemented System are as follows:

1. Webcam
2. Face.js (face-api.js) Library
3. Admin Dashboard
4. Database System
5. Email Notification Module (EmailJs).
6. Alarm System

5. CONCLUSION

In this project, we successfully developed the Border Surveillance System, a web-based intelligent security solution aimed at monitoring and protecting restricted areas from unauthorized access. The system integrates a webcam for continuous visual monitoring, FaceJs technology for real-time face detection and recognition, and automated alert mechanisms to respond to potential intrusions. Upon detecting an unknown individual, the system immediately generates a notification for the operator and, if access is denied, activates an alarm and sends an email alert with the captured image to the administrator.

This project demonstrates how modern web technologies and intelligent algorithms can be combined to create a real-time, automated, and scalable surveillance solution. By reducing the need for constant manual monitoring, the system minimizes human effort while improving response time and accuracy in identifying threats. It enhances overall security management, particularly in sensitive and high-risk zones, and provides a reliable, cost-effective approach to modern surveillance infrastructure.

6. REFERENCES

1. R. A. Deshmukh, Shubham Kamdi, Mohak Pingle, Shivani Raje Bhosale, Asawari Bhosale, “Intelligent surveillance system using energy efficient intrusion detection and tracking techniques”, 2nd International Conference on Electronics, Communication and Aerospace Technology (ICECA), pp. 1214-1218, IEEE, 2018

2. Sagar R N, Sharmila S P, Suma B V, “Smart Home Intruder Detection System”, International Journal of Advanced Research in Computer Engineering and Technology (IJARCET), Vol:6 No:4, pp. 439-443, 2017

3. Dushyant Kumar Singh, Dharmender Singh Kushwaha, “Automatic Intruder Combat System: A way to Smart Border Surveillance”,Defence Science Journal, Vol:67 No:1, pp. 50-58, 2016

4. Alazzawi, Lubna, Alkhathami,Mosad and Elkateeb, Ali. "Border Surveillance and Intrusion Detection Using Wireless Sensor Networks," International Journal of Advances in Engineering & Technology, 8, pp. 17-29, 2015.

5. Palagati Harish, R. Subhashini, K. Priya, “Intruder Detection by Extracting Semantic Content from Surveillance Videos”, International Conference on Green Computing Communication and Electrical Engineering (ICGCCEE), pp. 1-5, IEEE, 2014

6. Zhang, Lijing & Liang, Yingli. "Motion human detection based on background subtraction," 2010 Second International Workshop on Education Technology and Computer Science, pp. 284287, 2010.